DOCUMENT RESUME

ED 427 696 IR 019 247

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TITLE SLATE: Space for Learning and Teaching Exploration.
PUB DATE 1998-11-00
NOTE 7p.; In: WebNet 98 World Conference of the WWW, Internet, and Intranet Proceedings (3rd, Orlando, FL, November 7-12, 1998); see IR 019 231. Figures may not reproduce clearly.
PUB TYPE Reports - Descriptive (141) -- Speeches/Meeting Papers (150)
EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Authoring Aids (Programming); *Computer Assisted Instruction; Computer Software Development; Computer System Design; *Courseware; Educational Technology; Higher Education; Information Technology; Instructional Design; Mathematics Education; *Mathematics Teachers; Multimedia Materials; *Preservice Teacher Education; Student Teachers; World Wide Web
IDENTIFIERS Digital Technology; *Learning Environments; Technology Integration; University of Michigan; *Video Technology; Virtual Classrooms

ABSTRACT

Through the use of comprehensive instructional design and sophisticated information technologies, the University of Michigan School of Education has reinvented the way it educates prospective mathematics teachers. A new World Wide Web-based instructional environment called SLATE (Space for Learning and Teaching Exploration) combines digital video, searchable transcripts, basic multimedia authoring, and other new media applications to provide a shared experiential frame and a range of investigation previously unavailable to student teachers. This paper discusses the technical design of the SLATE environment, budget and staffing, summary of outcomes, and future developments. Five figures illustrate features of the technology, and a table charts staffing hours used on the SLATE project. (Author/AEF)

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SLATE: Space for Learning and Teaching Exploration

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Abstract: Through the use of comprehensive instructional design and sophisticated information technologies, the University of Michigan School of Education has reinvented the way it educates prospective mathematics teachers. A new web-based instructional environment called SLATE (Space for Learning and Teaching Exploration) combines digital video, searchable transcripts, basic multimedia authoring, and other new media applications to provide a shared experiential frame and a range of investigation previously unavailable to student teachers. This document is also available online: murph.soe.umich.edu/SLATE/SLATE.htm

1. Introduction and Background

As part of their professional training and certification, every preservice teacher spends time in real classrooms under the close mentorship of cooperating practitioners. This apprenticeship period ensures that preservice teachers have had guided, first hand experience in live environments before embarking on careers with their own students. Furthermore, a significant element of preservice teacher preparation is the shared analysis and discussion of these preservice teaching experiences.

Unfortunately, preservice teachers' placement experiences often vary dramatically due to differences in the style and engagement of their mentor teachers and the classroom cultures into which they have been placed. This variance complicates the process of establishing a shared experiential "text" upon which to base methodological discussion. Faculty at the University of Michigan School of Education have recognized the challenges inherent in providing both live classroom placements for preservice teachers and shared classroom experiences for use in socially constructed knowledge building. Dr. Magdalene Lampert's *Mathematics and Teaching through Hypermedia (MATH)*project, Dr. Anne Gere's *Technology Assisted Teacher Education (TATE)*project, and now Dr. Deborah Ball's *SLATE* project are just a few of the initiatives that have sought to address this challenge through the use of emerging technologies. This paper describes the development and functionality of the SLATE project as well as some of the pedagogical underpinnings of the project.

SLATE was conceived in the Summer of 1995 when Dr. Ball began considering the inherent problems with shared context in preservice teacher education placements and how previous attempts to address the issue might be improved. Her discussions with technical staff were informed by close experience with earlier tools including the Student Learning Environment developed by Kara Suzuka under the MATH project (co-directed by Dr. Ball and Dr. Lampert and funded by the National Science Foundation and Michigan State University).

The resulting SLATE design draws heavily upon the Student Learning Environment, but also adds a significant number of features and tools previously unavailable. The Student Learning Environment is a HyperCard-based engine for accessing a variety of multimedia data collected over the course of a year in two elementary school mathematics classrooms. These data, including video and transcripts of the class sessions, digital images of student work, text of teacher journals, seating charts and standardized test scores (among other things), were gathered together and made available for student searching and incorporation into original multimedia compositions. The environment has a number of limitations however, including a lack of random access to all of the video (which is stored on laserdiscs), difficulty searching across the entire data set (for occurrences of a

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particular text string, for example), a lack of robust student authoring tools (Microsoft Word and HyperCard have been used with varying degrees of success), and a lack of portability (the environment is difficult to setup and is sensitive to being moved).

After several weeks of analysis and discussion of previous environments, underlying instructional objectives, and technical constraints, a final SLATE design proposal emerged. The design was presented to the SOE/ITD Partnership (a joint venture of the School of Education and U-M's Information Division) which supported the project and sent it to the Office of Instructional Technology for development.

2. Technical Discussion

The completed SLATE environment consists of a several commercial software packages, a custom-developed environment manager, and custom server-side tools. Some specific features of the environment include:

• Access to collaborative assignments and notes from previous sessions is provided via an AppleShare server preconfigured for groups of students (arranged into cohorts). All student work is saved on the server, periodically reviewed by instructors, and backed up by project staff.

• Central control of the environment is provided via a custom-developed SuperCard application which communicates with the rest of the applications (Netscape, ClarisWorks, Adobe Acrobat).

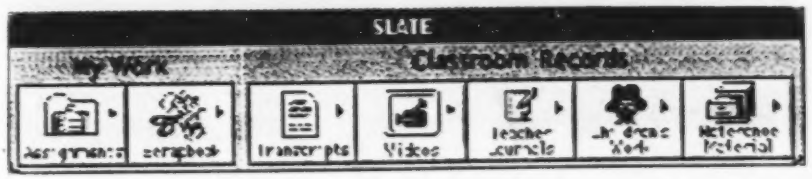

Figure 1: SLATE SuperCard application with pop-up access to media and tools

• High-quality video and corresponding transcript text is delivered to the desktop using MPEG playback and text-track features built into Apple Computer's QuickTime media technology. The video (and other environment media) is stored on an external 9 GB hard disc attached to each PowerMac 8600.

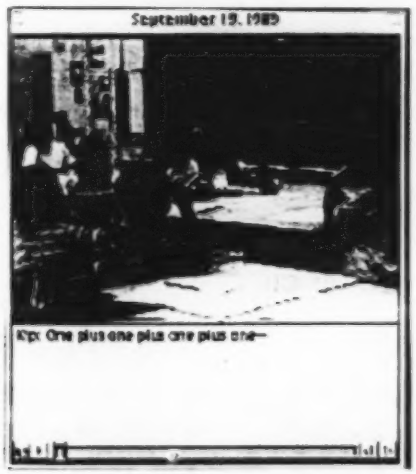

Figure 2: MPEG video and corresponding transcript presented in real time

• One-click transcript access to any point in the 30 hours of video is provided via a web interface.

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Figure 3: Transcript with links to video

• A web-based search engine utilizes HTML forms that are tied to a cgi search engine (which runs on a remote UNIX machine). Query results may be saved as HTML documents.

Figure 4: SLATE search engine

• Student authoring is facilitated through the use of predefined ClarisWorks templates. The ClarisWorks productivity suite provides drag-and-drop video editing, graphics manipulation and a full-fledged text editor for

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the creation of student multimedia artifacts.

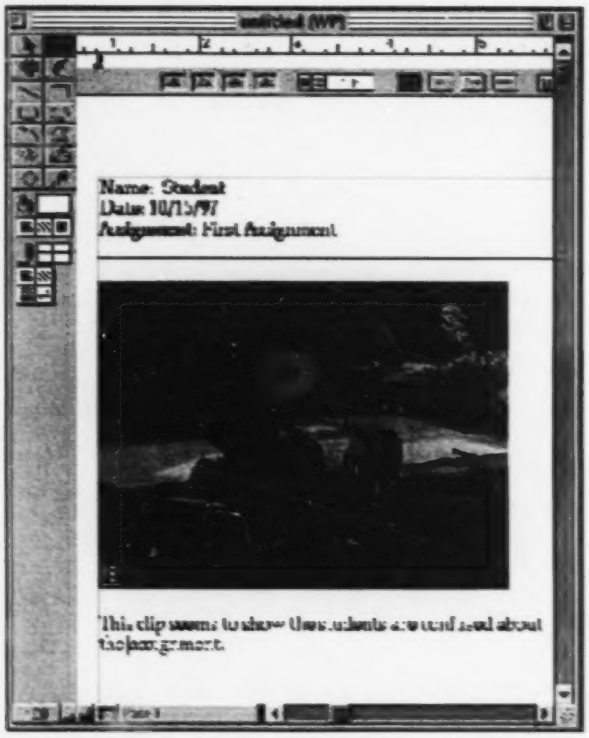

Figure 5: Student ClarisWorks document with embedded MPEG link

• A browser interface provides access to a variety of other data, including digital images of student work, seating charts, and teacher journals which are stored in Adobe Acrobat format.

During development, three separate teams were formed to concentrate on different aspects of the project. A technical team concentrated on software development issues and worked with a content team to address instructional objectives and overcome technical constraints. A facilities team directed the construction of the deployment space and ensured compliance with technical specifications.

It should be noted that SLATE was deployed in a new, high-end multimedia classroom designed specifically to support Dr. Ball's pedagogical approach which emphasizes collaborative exploration and discussion. The room, built in conjunction with the SLATE environment, was also supported by funds from the SOE/ITD Partnership.

3. Budget and Staffing

The development of SLATE has enlisted the services of numerous instructors, software designers and facilities professionals. An accurate estimate of total time invested is difficult to supply. However during the two years that transpired from the initial discussions in the Summer of 1995 to deployment in the Fall of 1997, the following rough staffing statistics were gathered:

Task	*Hours*

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Instructional design consulting	200
Project management	200
Production work (video capture, transcription, graphics translation)*	150
Development/coding (OIT)	250
Testing and deployment	100
Documentation (student guides)	50
Total Hours:	950

Table 1: Staffing hours used on the SLATE project

* Much of the media used in SLATE had been captured, cleaned and edited by previous MATH project efforts. For example, all of the video used in SLATE and the accompanying transcripts existed in edited form on laserdisc and in computer files. Had development of these media been necessary, the production effort for SLATE would have ballooned into thousands of hours.

Although the hourly rate of the staff involved in the project varied, an overall project budget of $35,000 has been spent to date. It should be noted the instructor time does figure into these staffing numbers. The instructional staff (faculty and graduate students) did not track their involvement, which almost certainly matched that of the technical staff and would likely double the total presented above. Obviously the staffing costs do not include the construction or outfitting (machines and software) of the multimedia classroom or any of the servers used by the project. If included, these infrastructure costs would add a half million dollars to the total project cost.

4. Summary of Outcomes

SLATE was deployed to four sections of Elementary Math Methods (Education 411), each containing 30 students, in the Fall semester of 1997. To ease the integration of the technology into the course, a detailed syllabus and course prospectus was delivered to students. Significant effort was made to communicate to the preservice teachers that SLATE is not intended as a replacement for actual classroom teacher experience, but rather that it provides an avenue to some of the shared context that would be the basis of classroom discussion. This sharing of a virtual classroom in parallel with the students' real placement experience, was a resounding success. Dr. Ball and her graduate student staff reported a level of discussion and engagement previously unseen in their courses.

The design philosophy of using off-the-shelf applications (as opposed to custom development) resulted in an uncommonly stable instructional environment. Furthermore, the leveraging of usability innovations such as drag-and-drop video editing, alias-based server access, and predefined document templates facilitated a new level of ease and sophistication of multimedia authoring. The technology also complemented the instructional approach of using collaborative learning teams, group exploration of the environment, and well-structured assignments.

5. Next Steps

Although the initial deployment of the SLATE environment was highly successful, a number of technical and non-technical next-steps have been identified.

A significant non-technical area of effort that will be undertaken is the recruitment of additional faculty to use the environment in different courses. Because the database does not contain explicit content codes (all data is coded based upon intrinsic characteristics such as date captured and type of media, not content abstractions like "multiplication" or "disagreement"), SLATE is generalizable to a variety of course topic areas. A faculty member interested in ethnic and gender issues, might for example, approach the environment with an entirely different set of investigational intents than a mathematics instructor. The development of a non-content specific guide to using the environment would significantly increase the likelihood of additional faculty using SLATE.

On the technical side, further documentation needs to be developed to allow instructors to more fully use the capabilities of the various tools in the environment. Knowledge of the text search and image manipulation tools built into Adobe Acrobat and ClarisWorks for example, may significantly enhance the instructor's ability to support and evaluate more sophisticated student work. Further testing and bug fixes, code normalization and minor feature enhancements round out the items for continued development.

Acknowledgements

The Space for Learning and Teaching Exploration was developed under the direction of the Mathematics Teaching and Learning to Teach project, led by Dr. Deborah Ball. SLATE was developed at the University of Michigan by the Office of Instructional Technology and funded by the School of Education in partnership with the Information Technology Division. More information about the MATH project, upon which some elements of SLATE are based, may be found online at www-personal.umich.edu/~jmerz/MATHproject/math.html

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